

**BURLINGTON COUNTY COLLEGE**

**EET 232**

**Analog Integrated Circuits**

**SYLLABUS**

**SPRING 2008**



## SYLLABUS SUMMARY for EET 232 Analog Integrated Circuits

LEC INSTRUCTOR: \_\_\_\_\_ OFFICE: \_\_\_\_\_ PHONE: (856)-222-9311 ext. \_\_\_\_\_

LAB INSTRUCTOR: \_\_\_\_\_ OFFICE: \_\_\_\_\_ PHONE: (856)-222-9311 ext. \_\_\_\_\_

### COURSE MEETINGS:

Twice weekly for three hours, Once for Lab & Once for HW Question/Answer session & Lecture.

### COURSE DESCRIPTION:

This course focuses on the characteristics and applications of analog integrated circuits including operational amplifiers and specialized linear integrated circuits. It investigates circuits including inverting, non-inverting and differential amplifiers, non-linear circuits, active filters, equalizers, oscillators, timers, and power supply regulator IC's. Laboratory experiments cover the above topics and verify lecture theory.

### REQUIRED TEXT & 3 RING BINDERS:

#### Required Text:

Text: Electronic Principles; by Albert Paul Malvino  
Sixth Edition, McGraw –Hill. ISBN 0-02-802833-3

Optional: EWB MultiSIM 10 Student Ed.\$40 at [www.ni.com/academic/multisimse](http://www.ni.com/academic/multisimse)

Two 3 Ring Binders 1 ½" To hold the Lectures, and HW.  
1" To hold the Labs

### EVALUATION:

- A. Two (2) excused absences are permitted per term. Students are expected to be on time and stay for the full duration of the class, otherwise they may be marked absent. If a student's absences are excessive, the instructor may assign the student an "F" grade for the course.
- B. Calculation of the Final Grade Point Average
- |                    |     |
|--------------------|-----|
| Test Grade Average | 50% |
| HW Grade Average   | 25% |
| Lab Grade Average  | 25% |
- C. Academic misconduct that disrupts the learning process in class such as leaving the classroom for cell phone conversations, can affect the final grade.

### FINAL GRADE BREAKDOWN:

A	90 to 100	C	70 to 74
B+	85 to 89	D	65 to 69
B	80 to 84	F	below 65
C+	75 to 79		

**COURSE SYLLABUS****COURSE #/TITLE: EET232 Analog Integrated Circuits****PREREQUISITES/COREQUISITES: EET-121****SEMESTER CREDIT HOURS: 4****INSTRUCTOR: \_\_\_\_\_ OFFICE: \_\_\_\_\_ PHONE: \_\_\_\_\_****COURSE MEETINGS: - 2 Days Per Week for 3 Hours Each.**

1 <sup>st</sup> Day	½ to 1 Hrs for HW Question/Answer Session
	2 ½ to 2 Hrs for Lecture.
2 <sup>nd</sup> Day	3 Hrs for Lab

**COURSE DESCRIPTION:**

This course focuses on the characteristics and applications of analog integrated circuits including operational amplifiers and specialized linear integrated circuits. It investigates circuits including inverting, non-inverting and differential amplifiers, non-linear circuits, active filters, equalizers, oscillators, timers, and power supply regulator IC's. Laboratory experiments cover the above topics and verify lecture theory.

**RATIONALE:**

Analog Integrated Circuits is required for the Electronics Engineering Technology program and is an elective for the Computer Servicing & Networking Technology program. Both A.A.S Degree programs prepare residents of Burlington County to qualify for job opportunities as an electronic technician.

This course or the EET program is transferable to most 4-year colleges including Drexel's BSAET and Temple or NJIT's BSET programs. This course or the CS&NT program is transferable to NJIT's BS degree in Engineering Technology with the Computer option.

**GENERAL COURSE GOALS:**

The student will acquire skills in the following areas:

1. Develop a knowledge of the applications that use linear ICs.
2. Develop a knowledge of the mathematics associated with Bode plots and converting gain to dB's using the log function.
3. Be able to properly use electronic test equipment to perform frequency response measurements using the sweep generator and the EWB Bode plotter
4. Be able to use EWB circuit analysis software's Bode Plotter to simulate frequency response.
5. Be able to build electronic circuits on proto boards from schematics.
6. Develop the ability to design electronic circuits with linear ICs.

## **ABET Accreditation of Burlington County College's Electronics Engineering Technology Program and Computer Servicing & Networking Technology Program**

**What is accreditation?** Accreditation is used to assure quality of programs in educational institutions. It requires our college and EET programs to meet certain, defined standards or criteria. There are two types of accreditation, institutional and specialized. Institutional accreditors, such as the Middle States Association of Colleges and Schools, are “regional” accreditors and examine the college as a whole. Specialized accreditors evaluate specific programs such as the engineering and technology programs. The Accreditation Board for Engineering and Technology (ABET) is a professional accrediting organization that accredits Electronics Engineering Technology and Engineering programs across the country.

**How does accreditation benefit the student?** Accreditation serves to notify parents and prospective students that a program has met accepted standards. Student work, faculty qualifications, laboratory resources and administrative support are evaluated for strengths and weaknesses and a report is issued on ways to improve the program. Employers know that these graduates are prepared to begin professional practice. Students who graduate from an ABET accredited institution have an easier time transferring to other ABET accredited institutions. Also, state licensing boards and certification programs may require graduation from an ABET-accredited program as the first step in the registration or certification process for professional practice. In some instances, ABET accreditation may permit students to receive federal funds in the form of scholarships, loans and grants.

## Program Outcomes (a – k) with EET 232 Course Objectives (1, 2, 3 etc.)

### The Graduate shall have:

Reference ABET  
Program Outcome  
Letters

- a. an appropriate mastery of the knowledge, techniques, skills, and modern tools used in an Electronics Laboratory, demonstrated by students having an ability to:
  1. use electronic test equipment including the digital oscilloscope, function generator, multimeter to make measurements such as frequency response using point-to-point measurements and using the sweep function generator
  2. use electronic circuit analysis software to analyze circuits such as using Electronic Workbench Bode Plotter to plot a filter's frequency response.
  3. build electronic circuits on a Protoboard from schematic diagrams
  4. solder printed circuit boards.
  
- b. an ability to apply current knowledge and adapt to applications of Electronics, demonstrated by students having an ability to:
  1. Design and build a circuit to the Final Outcomes Assessment Design Project Specifications.
  
- c. an ability to conduct, analyze, and interpret experiments and apply results to make improvements where applicable, demonstrated by students having an ability to:
  1. Build a 2<sup>nd</sup> order active filter (an improvement over a 1<sup>st</sup> order filter), based on library or Internet research and write a report that includes improvements in performance
  2. Design and build a circuit to the Capstone Outcome Assessment Design test to given project specifications.
  
- d. an ability to apply creativity in the design of circuits and systems appropriate to program objectives, demonstrated by students having an ability to:
  1. Design and build a circuit to the Capstone Outcomes Assessment Design test to given project specifications.

## Program Outcomes (a – k) with EET 232 Course Objectives (1, 2, 3 etc.)

### Continued

#### The Graduate shall have:

Reference ABET

Program Outcome

Letters

- f. an ability to identify the characteristics of, analyze, and solve problems for electronic circuits, demonstrated by students having an ability to:
  - 1. Pass Tests  
See sample tests
  
- g. an ability to communicate effectively, demonstrated by students having an ability to:
  - 1. write a report, using library or Internet research, on a 2<sup>nd</sup> order active filter.
  - 2. write a report, using Internet research, on the environmental impact of Hazardous substances in Electronics equipment.
  - 3. write a report on the Final Outcomes Assessment Design Project
  
- j. respect for diversity and a **knowledge of** contemporary professional, **societal, and global issues**, demonstrated by students having an ability to:
  - 1. write a report, using Internet research, on the environmental impact of Hazardous substances in Electronics equipment.
  
- k. a commitment to quality, timeliness and continuous improvement demonstrated by students having an ability to:
  - 1. have good Attendance and being on time
  - 2. take tests and turning in work on time
  - 3. make improvements in homework and lab reports, based on grading feedback.

## EET 232 Course Outline

**Lab #0** – Advanced Scope, Generator and EWB Measuring Techniques

**Unit 1 IC Construction, Operational Amplifier Characteristics, and the Inverting Amp**

**Lab #1** – Look at IC's under a microscope and An Inverting Walkman LM386 IC Power Amp

**Unit 2 The Non Inverting Amp, Negative Feedback, the Voltage Follower, the Summing Amp, the D to A Converter and the Subtracting Amp**

**Lab #2** – A Summing & Non Inverting Microphone LM386 IC Power Amp and Using **EWB** to analyze a Summing Amp.

*(TEST 1) – Units 1 & 2*

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**Unit 3 LOGS, dB, AC Analysis of Differential Amplifiers, Common Mode Gain & Common Mode Rejection Ratio (CMRR)**

**Lab #3** – A Microphone - Head Phone AC Differential Amplifier with Induced Common Mode 120Hz Hum and measuring the CMRR

**Unit 4 DC Bias Current & Voltage Offsets and DC Differential Instrumentation Amplifiers.**

**Lab #4** –The Glass Diode Digital Thermometer using a DC Differential Instrumentation Amp

*(TEST 2) – Units 3 & 4*

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**Unit 5 The Peak Detector, Clipper, Sample & Hold, Chopper, Squelch, AVC, and Log Amp**

**Lab #5** – The Automatic Volume Control (AVC)

**Unit 6 Comparators, Voice Operated SW (VOX), Photo Transistors & Diodes, Light Activated SW, Relays, Transistor Switches and the Schmitt trigger**

**Lab #6 A<sub>1</sub>** - The Voice Activated Switch **Soldering Skills test** – 50% of Lab 6 Grade or

**Lab #6 A<sub>2</sub>** - The LM311 Comparator & Photodiode Light Activated SW **Soldering Skills test**

**Lab #6B** - **Internet research report on environmental impact** of Hazardous substances in Electronics equipment – 50% of Lab 6 Grade

*(TEST 3) – Units 5 & 6*

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*Continued on next page.*

**Unit 7 The Integrator, Square & Triangle Wave Generators, & the Differentiator****Lab #7** The Exar 2206 1 Chip Function Generator.**Unit 8 The 555 Timer Pulse generation, Rectangular wave oscillators, Voltage Controlled Oscillators, Pulse Width Modulation & Class D Power Amps****Lab #8 – Use the 555 Timer** & software to build anAnalog **Frequency to Vout (F to V)** Converterto build a **Motor RPM, Analog Auto Tachometer, or Frequency Meter.****(TEST 4) – Units 7 & 8**

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**Unit 9 Bode Plots, Frequency Response Calc., & Gain BW Product of Amps and LPF, HPF, & BPF Using 1 or 2 Stage 1<sup>st</sup> Order, 6 dB / Octave, Active Filters****Lab #9 -- Basic Active Filter Lab**

– 6dB / Octave BPF – 2 Stages total; Plot Frequency Response using:

- 1) Point to Point Measurements
  - 2) The Sweep Function Generator and
  - 3) **Electronic Workbench Bode Plotter**
- 

**Unit 10 Advanced Active Filters 2<sup>nd</sup> Order - 12 dB / Octave – 2 Pole and Higher****(Test 5) Write Report using Internet or Library Research, on a 2<sup>nd</sup> Order - 2 Pole Filter****Lab #10 – Advanced Active Filter Research Lab**– **For Selected 2<sup>nd</sup> Order filters from Library or Internet, research:**(If you pick a 2 or 3 Stage Op-Amp Filter Circuit, you will get extra credit.) **or**– **For a Parametric Active Equalizer using an Op Amp:**

- 1) Build it and
  - 2) Measure it's Frequency Response, and
  - 3) **Plot its frequency Response using the EWB Bode Plotter**
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**Unit 11 Power Supply Integrated Circuit DC Voltage Regulators, Linear & Switching (PWM)****Lab #11** – Linear and Switching Regulated DC Supply For Auto Accessories**or**

(Optional) A Switching Step-Up DC Voltage Regulator.

(3V<sub>DC</sub> to 18V<sub>DC</sub> @ 30mA)

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**Unit 12 (Test 6) Individual Assessment Skills test** for assigned section of Capstone design project: Design, build on a protoboard, Draw a Schematic, & Write Report on Circuit Operation.**Lab #12 \_ Outcome Assessment Capstone Design Team project**

Combine individual section designs into a working system and write report on the project.

**COURSE MATERIALS:**

**A: Required Text:** (Purchase)

**Text:** Electronic Principles; by Albert Paul Malvino  
Sixth Edition, McGraw-Hill. ISBN 0-02-802833-3

**Optional:** EWB MultisIM 10 Student Ed. \$40 at [www.ni.com/academic/multisimse](http://www.ni.com/academic/multisimse)

**B: Required Calculator:** (Purchase)

A **Scientific Calculator** will be mandatory.

**Cell phone calculators are not allowed for Test!**

It should have **Rectangular to Polar Conversion**. (R↔P Buttons)  
for future courses. See **Calculator** page for further details.

**C. Lectures:** (Supplied)

**D. HW packet:** (Supplied)

Some Homework Questions and Problems will be printed out and  
some will be from the textbook.

To **qualify for HW credit**, HW Questions/Problems assigned from the  
textbook should be rewritten so you know what the answer is to.

**E. Laboratories:**

For each unit there will be a laboratory.

Laboratories will generally include:

1. Rationale / Objectives
2. List of equipment
3. References / Introduction / Set Up
4. Data
5. Calculations / Questions / Summary
6. Conclusion

**F: Syllabus, Reading, and IC Data Sheets.** (Supplied)

The reading assignments list the Reading Topics and Textbook page #.  
The reading topics are in an order that will "guide" the student  
through the Homework.

**G: Two Three-Ring Binders** (Purchase)

Put in **Binder #1** (1 ½"), the Lecture and HW Packets, and  
bring Binder #1 to the Lecture

Put in **Binder #2** (1"), the Labs and IC Data Sheets, and  
bring Binder #2 to the Laboratory.

**ATTENDANCE POLICY**

**Two absences are permitted during the term.**

**If a student's absences are excessive, he may be assigned a grade of "F".**

General Attendance Policy from Board Policy #206

"Students are **expected to attend all classes**, clinical, laboratory, and studio sessions **for the full duration** of each instructional session."

**Students are expected to be on time.**

Note: Attendance will be taken during Lecture and Lab.

A student who is **Late or leaves Early will be marked accordingly.**

**Poor Attendance will affect your grade. See pages 13, 15, 16 and 18.**

Excused absences as outlined in the student handbook generally require appropriate documentation.

Students are responsible to complete all missed course work for any type of absence.

**Students should set up a buddy system. Get phone # of at least one classmate to find out what is missed if absent, and to go over HW and study together.**

1<sup>st</sup> Person's Name: \_\_\_\_\_ Phone # \_\_\_\_\_

2<sup>nd</sup> Person's Name: \_\_\_\_\_ Phone # \_\_\_\_\_

Absences will not be counted in those cases where alternates to classroom activities are assigned during instructor attendance at professional conferences or meetings (e.g., NJEA Convention).

## PROFESSIONAL BEHAVIOR EXPECTATIONS

Students are expected to have a professional attitude in class as indicated by the following:

1. **Good attendance**
2. **Be on time for class and stay for the full duration.**
3. Prepared for class. ie. HW complete
4. Turn in assignments on time
5. Participate in class discussions but not talk out of turn.
6. Be an active lab group participant.
7. Have good lab work habits by:
  1. Turning off equipment.
  2. Putting parts back, and particularly resistors in their proper partition in the resistor drawer.
  3. Cleaning up lab benches and pushing in chairs when done.
8. Be respectful and courteous to other students and the instructor. Give assistance to other lab groups if they ask for help.

## UNACCEPTABLE / DISRUPTIVE BEHAVIOR

Disruptive behavior can include but is not limited to:

1. **Excessive talking in class** when the instructor or another student is talking. There should be only one person talking at a time in class. The Instructor or a student...not both.
2. Based on Jan 18, 07 Division meeting with the Academic Vice President, **ALL CELL PHONES ARE to be TURNED OFF During Class (Not Set to Vibrate)**  
If you are expecting an important call, let the instructor know ahead of time and sit by the door.  
  
**Excessive trips out of the classroom for cell phone conversations, snacks, bathroom, smoking, etc. during class can result in a failing grade as covered in the board policy on attendance. These matters should be taken care of outside of class time.**
3. **Other Inappropriate activities** include **computer email, chat-rooms, online shopping, etc.; cell phone activities, playing games, listening to CD's, MP3s, or iPod's** during Lecture or Lab.

These items represent Prohibited Conduct as outlined in the BCC Student Code of Conduct. Under the **sanctions**, the student could be **expelled from the class and receive an F grade.**

**LAB GRADE: Lab Grade Maximum is 10 Points & Counts 25% of Final Grade****1. Day One**

Remove staples from Lab Packet. Put separated Lab Packet into Binder #2 along with the Ancillary Packet material. Staple labs separately when turning in.

**2. Lab Double Check System:**

- a. **1st Check Off** is worth **5 points** and is given when:  
Initial data and calculations are correct.  
**The lab must be set up for first check off so if there are any mistakes, the set up can be checked for errors.**
- b. **The conclusion** is worth 2 Pts. of the 2<sup>nd</sup> Check-off, or 20% of the total lab grade. The conclusion must be typewritten using the format shown on page 14. At the end of the lab turn in your group's conclusion to the lab instructor for evaluation & only leave lab after the instructor returns marked-up conclusion.
- c. **2nd Check Off** is worth an additional **5 points** and is given when:  
 The lab report is complete, neat, and handed in on time.

3. **Attendance:** Attendance will be taken during lab. Students **must stay for the full duration** based on Board Policy, unless they complete the **entire lab** and have permission from the instructor to leave early. **Points will be taken off Lab grade for time missed during lab.**

4. **Lab Due Date:** Labs are due the next lab period for full credit. Labs turned-in one week late will be penalized one point (one letter grade). Labs turned-in two weeks late will be penalized two points (two letter grades). Labs more than three weeks late will be penalized 3 points (3 letter grades) etc.

5. **Make-up labs** There will be one day near the end of the semester when make-up labs can be done. Full credit will be given for a make-up lab provided the instructor's signature with the date is on the lab, and if handed in one week after performing the lab. This is important because to receive credit for a make-up lab you must have this signature and date.

6. **Electronic Workbench** analysis of the lab is worth 1 pt. of the 5 points in the second check-off **or 10% of the total lab grade** unless noted.  
 (Note: If the EWB part of the lab cannot be done during lab, it can be done outside of class time in the library.)

For a complete lab, two signatures are required and a maximum of 10 points given. If a lab is not handed-in no points will be given for that lab.

**Enter your lab grade points in table below:**

0. \_\_\_\_\_ 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_  
 7. \_\_\_\_\_ 8. \_\_\_\_\_ 9. \_\_\_\_\_ 10. \_\_\_\_\_ 11. \_\_\_\_\_ 12. \_\_\_\_\_

Drop Lowest Score

Total Points = \_\_\_\_\_

Lab Average = Total points ÷ Number of labs assigned.

**Lab Grade Average will count 25% of the final grade.**

## Labs Conclusion Format

**The Lab Conclusion is 20% of the Lab Grade.**

Use the following format when typing your lab conclusions. Notes relating to the lab conclusion may be handwritten during the lab period for reference when typing the final version. Use proper written English sentence structure & grammar. Discuss all topics on the conclusion page in a relevant and technical fashion. **The length of the conclusion should be between  $\frac{3}{4}$  and 1 page.** After completing the typed conclusion at the end of the Lab session, print it and turn it in to the instructor. Then, wait for instructor's evaluation before leaving the lab.

### Document Specs. for Lab Conclusion:

**font size:** 14 point font                      **font type:** Arial, Courier

**line spacing:** 2 (double)

**margins:**      left = 1.0"              right = 1.0"  
                  top = 1.0"              bottom = 1.0"

Note: Use the paragraph above as an example of the proper format.

## Lab Conclusion Instructions

- Each **lab group** will submit **one Conclusion with the names of all group members**.
- Names of lab partners must be put at the top of each member's lab,
- No group may leave early until the lab conclusion is typed, handed-in, evaluated by the lab instructor, returned to the lab group, changes made, and copies made for each lab group member.
- Any group that doesn't get to the conclusion by the end of the lab period should hand it in at the next class session (lecture or lab). The marked-up lab conclusions will be handed back at the following class session.
- Each member of a lab group must hand-in their own lab, with lab partners names at the top, and a corrected copy of the lab conclusion attached at the end.
- **One member must also attach the instructor's marked up conclusion at the end.**
- Conclusions may NOT be shared between groups.

## Lab Grading

	<u># of points deducted</u>
<b>Missed Lab time (late or left early) (See Next Page)</b>	<b>1 – 5</b>
Excessive consultations with lab instructor (or other lab groups).	1
Your name missing on top of first page of lab	1
Missing lab partner(s) names on top of first page of lab	1
Missing marked up evaluated conclusion	1/2
Sloppy work	up to 2
Calculations missing or incomplete	up to 2
No steps in calculations (answers only)	up to 2
Calculations with missing or wrong units and/or prefixes	up to 1
Questions not answered or answered incorrectly	up to 2
Graphs/plots not done or labeled improperly	up to 1
No conclusion	2
Conclusion not typed or wrong format	1
Conclusion answered with incomplete sentences and/or incorrect grammar	up to 1
Incorrect or irrelevant statements for Questions or Conclusion	up to 2

**Grading may seem strict at the beginning, so put in your best effort to get a good grade.**

## Timeliness in Attendance , Lab Submission, & Unit Tests

### Engineering Technology Criteria 2000

It is the responsibility of the institution seeking accreditation of an engineering technology program to demonstrate clearly that the program meets the following criteria.

#### Criterion 1. Students and Graduates

An engineering technology program must demonstrate that graduates have:

##### k. a commitment to quality, timeliness and continuous improvement.

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We expect students to arrive to class (and Lab) on-time and ready to work. Bathroom breaks, **must make/take cell phone calls**, etc. should be taken care of before class.

To encourage timeliness, late attendance minutes will be logged for each student for each lab throughout the semester. Points will be deducted for minutes late from the lab starting time of

For

15 min. to 30 min. = -1.5 pts.

31 min. to 45 minutes = -2.5 points

46 min. to 60 minutes = -3.5 points

more than 60 min. late = -4.5 points

The lab grade will include any points subtracted for late attendance and turning in labs late (discussed elsewhere in this syllabus).

Also, laboratories need to be handed in on time (usually one week after completing the lab).

One penalty point (10%) per week, will accumulate until the lab is handed in at which time they will be deducted from the lab grade.

Unit Tests need to be taken on time. In previous semesters, all of the students who put off taking Unit Tests until the end of the semester earned a C grade or lower on that test. With a documented excused absence, missed tests may be taken the week the student returns to class with no penalty. Each week after that, ten points will be subtracted from the graded test.

**HOMEWORK GRADE HW Maximum Grade is 5 Points & Counts 25% of Final Grade****. Question/Answer Session Grading:**

At the end of the question/answer session, HW will be collected. The HW grade is based on its state of completion, neatness, and that all steps to problem solutions are shown.

**If HW is not consistently done by the HW session the instructor may give an unannounced quiz at the beginning of the period. The pop quizzes, if given, will count 5% of the final grade.**

**Homework Grading:**

<u>HW Grade</u>	<u>for</u>	<u>% Complete</u>
5 Pts		90
4 Pts		80
3 Pts		60
2 Pts		40
1 Pts		20

- 1.) HW turned-in one week late will be penalized one point
- 2.) HW turned-in two weeks late will be penalized two points
- 3.) HW more than three weeks late will be penalized 3 points etc.
- 4.) HW with no steps in calculations will loose up to 50% off HW grade.
- 5.) Sloppy HW will loose up to 2 points off HW grade.

6.) **Also, 2 points will be taken off for missing text HW or text HW that doesn't have questions written out with schematic drawings.**

Enter your Homework Points in the table below:

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_  
 5. \_\_\_\_\_ 6. \_\_\_\_\_ 7. \_\_\_\_\_ 8. \_\_\_\_\_  
 9. \_\_\_\_\_ 10. \_\_\_\_\_ 11. \_\_\_\_\_

Drop the lowest score.

Total Points = \_\_\_\_\_

HW Grade Average = Total points ÷ Number of HW assignments x 20.

**The HW Grade average will count 25% of the final grade.**

**TEST REQUIREMENTS: Test Grade Average Counts 50% of the Final Grade**

1. **Tests must be taken on time.**
2. All cell phones **must be off NOT Vibrate** and **put in back pack** during the test. You **cannot use cell phone calculators for the test.**
3. You **cannot leave the class during a test.** If you leave the class during the test, **the test will be collected.**
4. You will be allowed to take **one late test** at end of term **with no penalty.**
5. For 2 or more late tests **10% will be deducted for each week** the test is late.
6. **No low test grades will be dropped.**
7. **One retest** will be given to **replace your lowest grade if it is below 80%** This will be **given at the end of the term.** The **maximum score is 80%.**

Enter your Test grades in the table below:

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_  
 Total Test Points = \_\_\_\_\_ (Filter Report) (Capstone Design Test)

Test Average = Total points ÷ (Number of Tests \* 100)

**The Test Grade Average will count 50% of the final grade.**

**OTHER FACTORS AFFECTING FINAL GRADE:**

If a student has attendance, cell phone, or inappropriate computer activity problems during lecture or lab, he/she can loose as much as 5% off the final grade for minor disturbances, or an F Grade for consistent major disturbances.

**Items to improve Final grade:**

1. **Professional attitude** for: Outstanding Attendance, on time, class contributions, and willingness to help others.  
**Add up to ½ point to Final grade.**
2. **Buy back all labs & HW for ABET accreditation.** Add up to 1 point (depending on % of material turned in) to Final grade.
3. **Submit English Papers** on the Topics of: Lifelong learning, professional, ethical, and social responsibilities, respect for diversity and a knowledge of contemporary professional, societal, and global issues. **¼ pt for each**

**CALCULATIONS OF FINAL GRADE POINT AVERAGE:**

Test Grade Average	_____	x .50 =	_____
HW Grade Average	_____	x .25 =	_____
Lab Grade Average	_____	x .25 =	_____
Final Grade Point Average			= _____

**GRADES:****A. To pass the course all units must be completed.**

The grade is based on all Four items listed below.

All four conditions must be met to receive a particular grade.

1. All units completed,
2. Minimum grade point average, and
3. Minimum number of labs completed.

<u>Grade</u>	<u>Final Grade Pt. Avg.</u>	<u>Units Completed</u>	<u>Minimum Number of Labs Completed</u>
A	90 to 100	All	10
B+	85 to 89	All	9
B	80 to 84	All	9
C+	75 to 79	All	8
C	70 to 74	All	8
D	65 to 69	All	8
F	below 65	1 or more not completed	less than 8

**B. Explanation**

All required labs must be completed to pass the course. In addition there are optional labs. Some or all of these optional labs must be completed for an A or B grade.

For example, for a C grade you must complete all units, the 8 required labs, and have a 70% (minimum) Final grade point average.

**If you completed all units, had an 83% Final average (qualifying for a "B" grade) but only completed 8 labs your grade would be a "C+".**

In other words all four conditions must be met. Grade point average, all units completed, and a minimum number of labs completed to receive a particular grade.

## EXPLANATION OF OTHER GRADES

1. If a **D** grade is received it will not satisfy the prerequisite requirement for the next course and it is not transferable to other colleges.
2. An **F** grade is assigned if any one of the four conditions for a D is not met. An F can also be given for cheating, excessive absences, game playing, or academic misconduct. **Academic misconduct includes any misconduct or behavior of a student which disturbs the learning process in class.**
3. An **"I"** (Temporarily Incomplete) is rarely issued. An "I" grade will only be issued for a student that **was unable to show up for the last week due to a documented emergency.**

The "I" grade can only be assigned upon mutual agreement between the student and instructor if everything except the last week of work has been completed, and the student fills out the "Incomplete" form. The student must complete work within 30 days of the beginning of the next term, otherwise that "I" will automatically become an F.

**The student must fill out the "I Contract" to receive an I grade.**

4. **Withdraw** - If a student finds it necessary to withdraw from the course he/she **must do so before the ninth week** by notifying the instructor and registrar and by completing the withdrawal form.

After the ninth week the student will receive a grade based on work in the course. Do not expect to withdraw the "last day" of the course to avoid a failing grade.

**Check with the registration office for the last day to withdraw.**

5. An **"X"** or (extended incomplete) grade will be given for a final grade only if a student requests it and **fills out the "extended incomplete" form**. The "X" will become an F if the student does not retake the course within one year.
6. An **"AU"** (Audit) grade can be assigned to anyone who has the Division Chairperson's signature and notifies the instructor at the beginning of the course. Students who audit a course are excused from all tests and receive only an "AU" letter grade.

**CALCULATORS:**

Students are **required to own** and know how to operate **a calculator** for HW, **and bring to class for Labs and Tests.**

**Cell phone calculators are not allowed for tests.**

Useful features to look for when shopping for a calculator:

**Common Functions:**

$1/x$ , $X \leftrightarrow Y$	<b>EE</b> for entering a number in scientific notation <b>+/-</b> for changing the sign of a number or exponent
$x^2$ , $\sqrt{x}$	<b>SCI, ENG</b> changes how the display represents powers of 10 notation
$y^x$ , $\sqrt[x]{y}$	
$\text{Log } X$ , $10^x$	<b>D<math>\leftrightarrow</math>R</b> (Conversion between Degrees and Radians.)
$\text{Ln } x$ , $e^x$	$\pi$

**Trig Functions:**

Sin	Arc Sin, Inv Sin or $\text{Sin}^{-1}$
Cos	Arc Cos, Inv Cos or $\text{Cos}^{-1}$
Tan	Arc Tan, Inv Tan or $\text{Tan}^{-1}$

A convenient feature is **Rectangular to Polar coordinate conversion.**  
**R $\leftrightarrow$ P** button

Example of work saved by using this feature:

$$\text{Rectangular to Polar: } a + jb \Rightarrow M = \sqrt{a^2 + b^2}; \quad \theta = \text{TAN}^{-1} \frac{b}{a}$$

$$\text{Polar to Rectangular: } M \cos \theta + jM \sin \theta \Rightarrow a + jb$$

**SUGGESTED STUDY PLAN:**

1. Attend the lecture, lab sessions and the question/answer sessions.
2. bring to lecture Binder #1, containing the lecture and HW Packets.  
bring to Lab Binder #2, containing the Lab and IC Data Sheets.
3. Read over all your lecture notes.
4. Read the reading assignment given for the first group of topics.
5. Answer the homework questions associated with these topics.
6. Read the reading assignment given for the next set of topics.
7. Answer the homework questions associated with this set of topics.
8. Continue this format until all Homework questions are answered.
9. Review the study guide HW questions, lecture notes, and labs for the test (Study a minimum of 1 Hour.). If there are no HW questions on a certain part of the lecture notes, do not assume they won't be on the test.
10. Keep all material in two three-ring notebooks so they won't get lost.

**RATIO OF CLASS TIME TO STUDY TIME**

The ratio to class time to study time is expected to be 1:2. Therefore, for the 4 credit hours of class time, **8 hours of study time are required.**

A student with **12 course credits** should allocate **24 hours of study time** (outside of class time) for a total time allocation of 36 hours / week.

Do not expect to pass all your classes if you work full time (40 hrs/week) AND have enrolled in a full time class load of 12 or more credits.